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Smith**

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- (54) **LASER-DRIVEN LIGHT SOURCE**
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- (*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 452 days.

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G01J 3/10 (2006.01)
H05G 2/00 (2006.01)
 - (52) **U.S. Cl.** **250/504 R**; 250/423 P;
250/426; 250/493.1; 438/104; 438/301; 438/513;
438/156; 252/301.36; 252/301.16; 252/301.4 F;
385/31; 385/33; 385/38
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250/423 P, 426, 493.1; 438/104, 301, 513,
438/156; 252/301.16, 301.36, 301.4 F; 385/31,
385/33, 38
- See application file for complete search history.

- (56) **References Cited**
U.S. PATENT DOCUMENTS
6,288,780 B1 9/2001 Fairley et al. 356/237.1
6,788,404 B2 9/2004 Lange 356/237.2
2004/0264512 A1 12/2004 Hartlove et al. 372/5

2005/0167618 A1* 8/2005 Hoshino et al. 250/504 R
2007/0228300 A1* 10/2007 Smith 250/504 R

FOREIGN PATENT DOCUMENTS

JP 61-193358 8/1986

OTHER PUBLICATIONS

Wilbers et al., "The VUV Emissivity of a High-Pressure Cascade Argon Arc from 125 to 200 nm," *J. Quant. Spectrosc. Radiat. Transfer*, vol. 46, 1991, pp. 299-308.
Wilbers et al., "The Continuum Emission of Arc Plasma," *J. Quant. Spectrosc. Radiat. Transfer*, vol. 45, No. 1, 1991, pp. 1-10.
Beck, "Simple Pulse Generator for Pulsing Xenon Arcs with High Repetition Rate," *Rev. Sci. Instrum.*, vol. 45, No. 2, Feb. 1974, pp. 318-319.
Raizer, "Optical Discharges," *Sov. Phys. Usp.* 23(11), Nov. 1980, pp. 789-806.
Fiedorowicz et al., "X-Ray Emission from Laser-Irradiated Gas Puff Targets," *Appl. Phys. Lett.* 62(22), May 31, 1993, pp. 2778-2780.
Keefe et al., "Experimental Study of a Stationary Laser-Sustained Air Plasma," *Journal of Applied Physics*, vol. 46, No. 3, Mar. 1975, pp. 1080-1083.

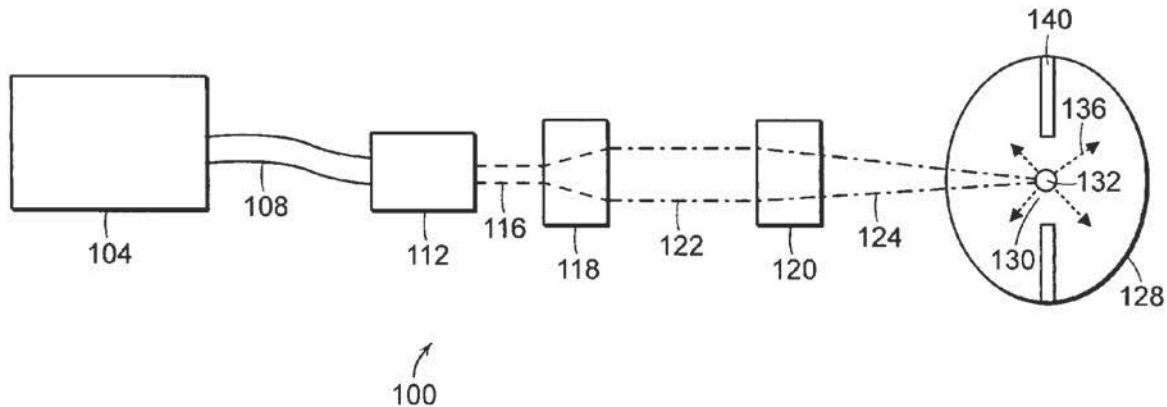
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(57) **ABSTRACT**

An apparatus for producing light includes a chamber and an ignition source that ionizes a gas within the chamber. The apparatus also includes at least one laser that provides energy to the ionized gas within the chamber to produce a high brightness light. The laser can provide a substantially continuous amount of energy to the ionized gas to generate a substantially continuous high brightness light.

81 Claims, 4 Drawing Sheets



OTHER PUBLICATIONS

Jeng et al., "Theoretical Investigation of Laser-Sustained Argon Plasmas," *J. Appl. Phys.* 60(7), Oct. 1, 1986, pp. 2272-2279.

Franzen, "CW Gas Breakdown in Argon Using 10.6- μ m Laser Radiation," *Appl. Phys. Lett.*, vol. 21, No. 2, Jul. 15, 1972, pp. 62-64.

Moody, "Maintenance of a Gas Breakdown in Argon Using 10.6- μ cw Radiation," *Journal of Applied Physics*, vol. 46, No. 6, Jun. 1975, pp. 2475-2482.

Generalov et al., "Experimental Investigation of a Continuous Optical Discharge," *Soviet Physics JETP*, vol. 34, No. 4, Apr. 1972, pp. 763-769.

Generalov et al., "Continuous Optical Discharge," *ZhETF Pis. Red.* 11, No. 9, May 5, 1970, pp. 302-304.

Kozlov et al., "Radiative Losses by Argon Plasma and the Emissive Model of a Continuous Optical Discharge," *Sov. Phys. JEPT*, vol. 39, No. 3, Sep. 1974, pp. 463-468.

Carlhoff et al., "Continuous Optical Discharges at Very High Pressure," *Physica* 103C, 1981, pp. 439-447.

Cremers et al., "Evaluation of the Continuous Optical Discharge for Spectrochemical Analysis," *Spectrochimica Acta*, vol. 40B, No. 4, 1985, pp. 665-679.

Kozlov et al., "Sustained Optical Discharges in Molecular Gases," *Sov. Phys. Tech. Phys.* 49(11), Nov. 1979, pp. 1283-1287.

Keefer, "Laser-Sustained Plasmas," *Laser-Induced Plasmas and Applications*, published by Marcel Dekker, edited by Radziemski et al., 1989, pp. 169-206.

Hamamatsu Product Information, "Super-Quiet Xenon Lamp Super-Quiet Mercury-Xenon Lamp," Nov. 2005.

* cited by examiner

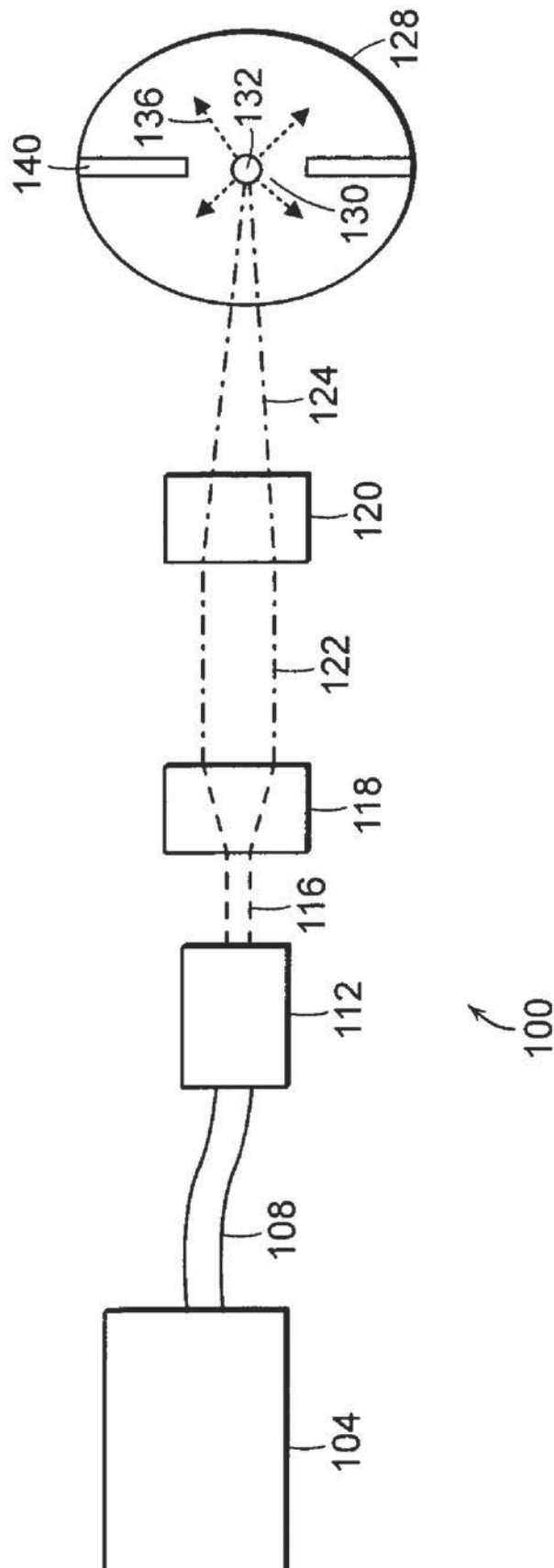


FIG. 1

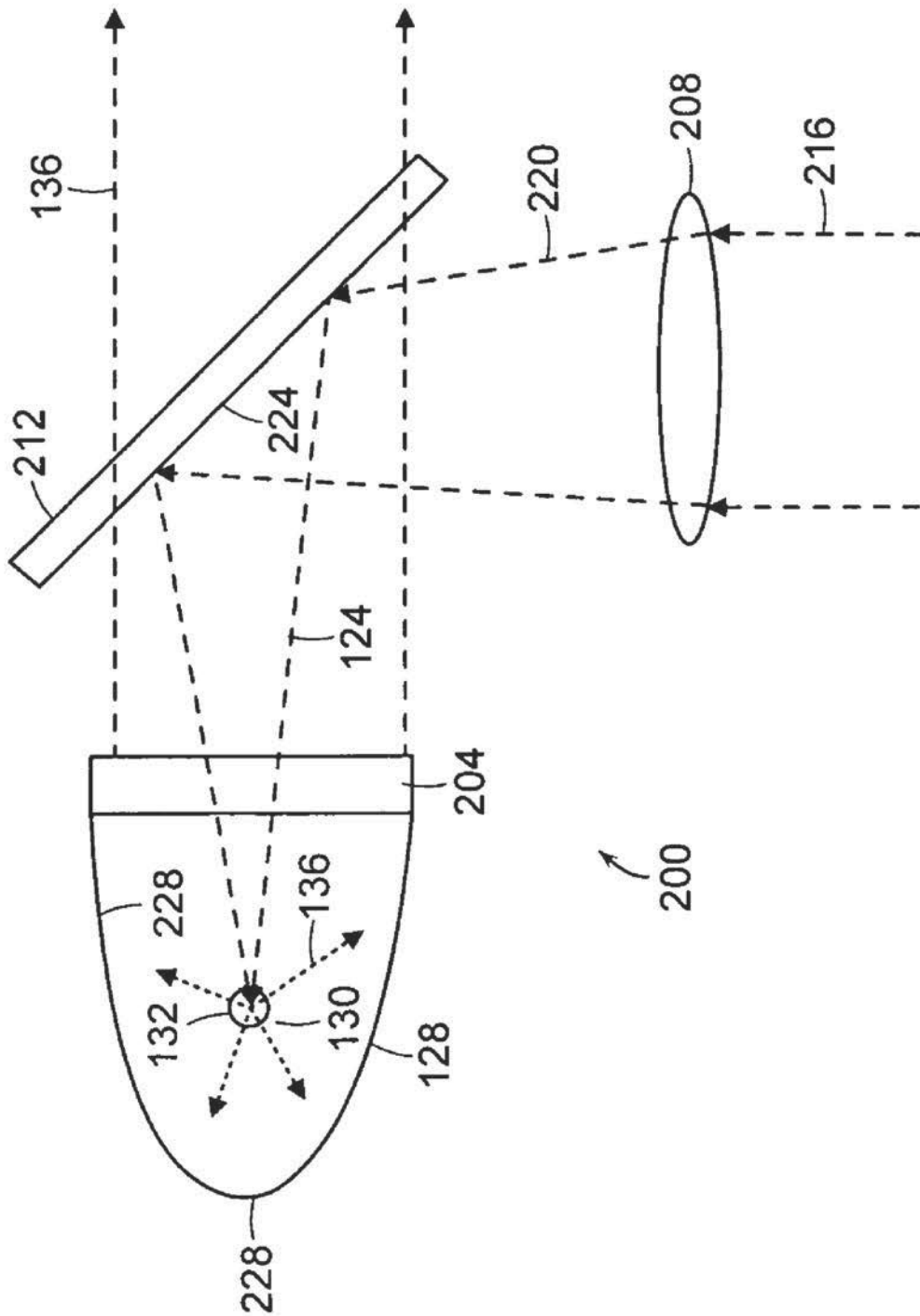


FIG. 2

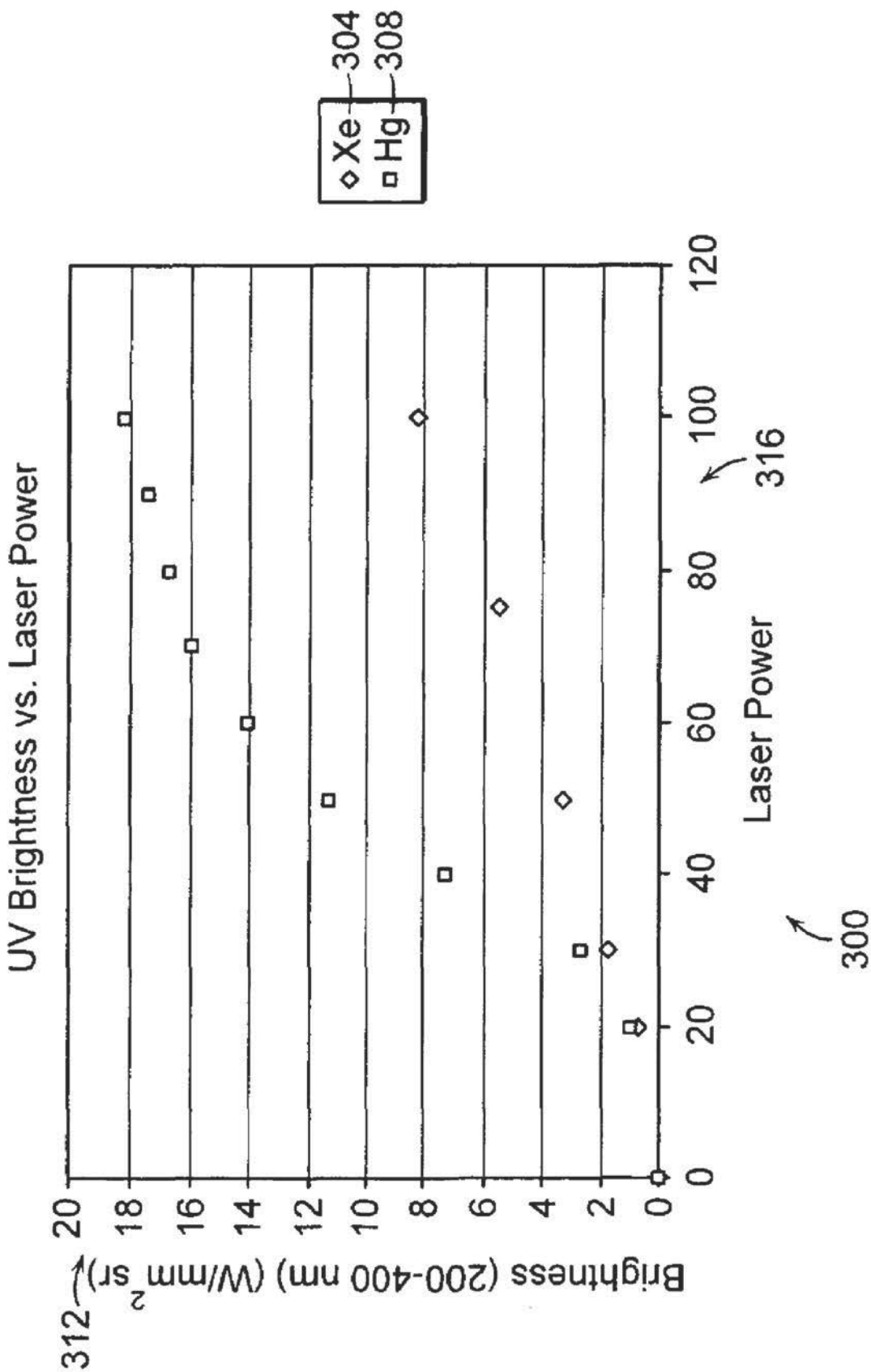


FIG. 3

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